Global Hydrology Resource Center

Data User Guide

GPM Ground Validation Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) IFloodS

Introduction

The GPM Ground Validation Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) IFloodS dataset is a subset from the global 30-minute PERSIANN-CCS files generated in near-real time selected for the time period of the GPM Ground Validation Iowa Flood Studies (IFloodS) field campaign. The main goal of IFloodS were to collect detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and to simultaneously collect data from satellites passing overhead. This PERSIANN-CCS data product is available in ASCII and netCDF-4 formats from April 1, 2013 thru July 1, 2013.

Notice:

The GPM Ground Validation Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) IFloodS dataset is a subset from the global 30-minute PERSIANN-CCS files generated in near-real time available at the CHRS UC Irvine Data Portal.

Citation

Braithwaite, Dan. 2017. GPM Ground Validation Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) IFloodS [indicate subset used]. Dataset available online from the NASA EOSDIS Global Hydrology Resource Center Distributed Active Archive Center, Huntsville, Alabama, U.S.A. doi: http://dx.doi.org/10.5067/GPMGV/IFLOODS/PERSIANN/DATA101

Keywords:
NASA, GHRC, GPM GV, IFloodS, Iowa, PERSIANN-CCS, model, algorithm, precipitation, rainfall rate

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint agency/international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). Surface rainfall was measured by very dense rain gauge and disdrometer networks at various field campaign sites. These field campaigns accounted for the majority of the effort and resources expended by GPM GV. More information about the GPM mission is available at https://pmm.nasa.gov/GPM/.

The Iowa Flood Studies (IFloodS) campaign was a ground measurement campaign that took place in eastern Iowa. The goals of the campaign were to collect detailed measurements of precipitation at the Earth's surface using ground instruments and advanced weather radars and to simultaneously collect data from satellites passing overhead. The ground instruments characterize precipitation – the size and shape of raindrops, the physics of ice and liquid particles throughout the cloud and below as it falls, temperature, air moisture, and distribution of different size droplets – to improve rainfall estimates from the satellites, and in particular the algorithms that interpret raw data for the GPM mission's Core Observatory satellite, which launched in 2014. More information about IFloodS is available at https://ghrc.nsstc.nasa.gov/home/field-campaigns/ifloods. Additional information about the Iowa Flood Center is available at http://iowafloodcenter.org/.

Data Product/Algorithm Description

The PERSIANN-Cloud Classification System (PERSIANN-CCS) is a global high resolution satellite derived precipitation product developed by the the Center for Hydrometeorology and Remote Sensing (CHRS) at the University of California, Irvine. The PERSIANN-CCS product employs a cloud patch classification and rainfall estimate system to derive rainfall rate based on infrared brightness temperature imagery collected by instruments such as GOES-8, GOES-10, GMS-5, METEOSAT-6, and METEOSAT-7. The infrared images are segmented into cloud patches from which the cloud patch features are extracted. These features include the cloud patch geometry, statistics and textural variation at different brightness temperatures. The cloud patch features are then categorized into clusters using a self-organizing map (SOM) artificial neural network. Once the relationship between the brightness temperature of the categorized cloud patch clusters and the rain rate is determined, a probability match method (PMM) and exponential curve fitting is used to generate the final PERSIANN-CCS product values.

The PERSIANN algorithm is regularly updated using rainfall estimates from low-orbital satellites, including Tropical Rainfall Measuring Mission (TRMM), DMSP F13, F14, and F15, Aqua, and Global Precipitation Measurement (GPM). Figure 1 shows a data processing flow graphic of the PERSIANN algorithm. More information about the PERSIANN-CCS algorithm and data product is available at http://chrsdata.eng.uci.edu/, The PERSIANN System Fine Resolution Precipitation Estimates Using PERSIANN-Cloud Classification System, and Mahrooghy et al., 2012.

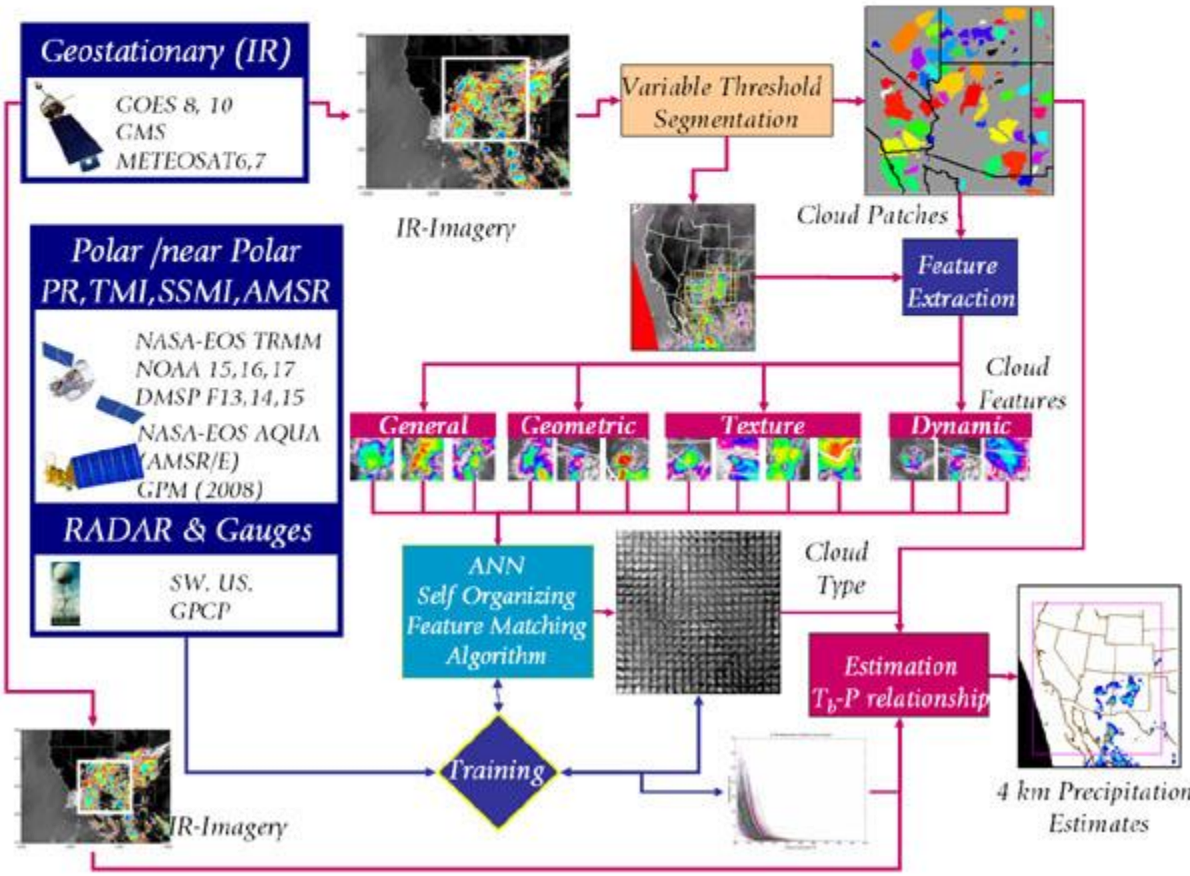

Figure 1: Data processing flow graphic
(Image source: The PERSIANN System Fine Resolution Precipitation Estimates Using PERSIANN-Cloud Classification System)

Investigators

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Data Characteristics

The GPM Ground Validation Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks Cloud Classification System (PERSIANN-CCS) IFloodS data are available in ASCII and netCDF-4 format files at a Level 4 data processing level. More information about the NASA data processing levels is available here. These level 4 data contain rainfall rate measurements derived from various satellite instruments..

Table 1: Data Characteristics

Characteristic	Description
Platform	GOES-8, GOES-10, GMS-5, METEOSAT-6, METEOSAT-7, NOAA-15, NOAA-16, NOAA-17, TRMM, DMSP F13, F14, and F15, Aqua, GPM
Instrument	PR, TMI (TRMM) SSMI (DMSP F13, F14, and F15) AMSR-E (Aqua)
Projection	n/a
Spatial Coverage	N: 45.24 , S: 39.36, E: -87.16, W: -96.84 (Iowa)
Spatial Resolution	4 km
Temporal Coverage	April 1, 2013 - July 1, 2013
Temporal Resolution	30 minutes
Parameter	Rainfall rate
Version	1
Processing Level	4

File Naming Convention

The GPM GV PERSIANN-CCS IFloodS dataset uses the file naming convention shown below. The data files are in ASCII and netCDF-4 formats.

Data files: ifloods_persiann_rccs_ifYYYYMMDDhhmm.[asc|nc]

Table 2: File naming convention variables

Variable	Description
YYYY	Four-digit year
MM	Two-digit month
DD	Two-digit day
hh	Two-digit hour in UTC
mm	Two-digit minute in UTC
[asc|nc]	asc = ASCII format text file nc = netCDF-4 format

Data Format and Parameters

The GPM GV (PERSIANN-CCS) IFloodS ASCII and netCDF-4 data files contain rainfall rate measurements. Table 3 describes the data fields within the netCDF-4 data files.

Table 3: Data Fields in netCDF-4 files

Field Name	Description	Data Type	Unit
latitude	Latitude of the observation	float	Degrees North
longitude	Longitude of the observation	float	Degrees West
rainrate	Rainfall rate. All data values < 0 have been set to 0, and _FillValue has been set to 0 to enable transparency when visualized	float	mm/hr
time	Time of measurement	int	Seconds since YYYY-MM-DD hh:mm:ss shown in filename

Software

These data are in ASCII and netCDF-4 formats, so no software is required to view these data; however, Panoply can be used to easily visualize the netCDF-4 data files.

Known Issues or Missing Data

Missing data values, or data less than 0, in the ASCII data are distinguished as -9999; however, within the netCDF-4 data files, all rain rate data values < 0 mm/hr and pixels lacking data are set to 0 to enable transparency when visualized.

References

Hong, Yang, David Gochis, Jiang-Tao Cheng, Kuo-Lin Hsu, and Soroosh Sorooshian (2006): Evaluation of PERSIANN-CCS Rainfall Measurement Using the NAME Event Rain Gauge Network. *Journal of Hydrometeorology*, 8, 469-482. doi: https://doi.org/10.1175/JHM574.1

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Mahrooghy, Majid, Valentine G. Anantharaj, Nicolas H. Younan, James Aanstoos, and Kuo-Lin Hsu (2012): On an Enhanced PERSIANN-CCS Algorithm for Precipitation Estimation. *Journal of Atmospheric and Oceanic Technology*, 29, 922-932. doi: https://doi.org/10.1175/JTECH-D-11-00146.1

Related Data

All data from other instruments collected during the IFloodS field campaigns are related to this dataset. Other IFloodS campaign data can be located using the GHRC HyDRO 2.0 search tool.

Contact Information

To order these data or for further information, please contact:

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